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Optimizing duration of hydro priming for seed quality enhancement in basil (*Ocimum basilicum* L.)

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Abstract
Poor seed germination is one of the major problem incultivation of medicinal plants. Seed priming is an efficient method for increasing of seed vigour and improvement of germination and seedling growth. The laboratory experiment was conducted at the Seed Science and Technology unit, Department of plant breeding and Genetics, Agricultural College and Research Institute, Killikulam to improve the seed germination and vigour potential of seeds. The present study was conducted to examine the effect of hydro priming (non-priming (control), 2h, 4h, 6h, 8h and 12 hours hydro priming) treatment on seed parameters of Basil (*Ocimum basilicum*). The results showed that the effect of hydro priming was significant on germination percentage and seedling vigour Mean comparison showed that the maximum germination (70 %), shoot length (2.4cm), root length (1.9 cm), and vigour index (301) were achieved at12 h of seed priming compared to control. Moreover, hydro priming 12 h treatment can be successfully applied on basil seeds to improve physiological performance.

Keywords: Basil-seed priming- germination percentage-seed vigour

Introduction
Indian basil (*Ocimum basilicum* L.; family Lamiaceae) is an industrially important source of essential oil and aromatic chemicals. Its essential oil is widely used in high-grade perfumes, aromatherapy, flavoring liquors, soups, and sauces, and as herbal spice, fly repellant, and medicine (Kumar *et al*. 2004) [4]. India has registered a growth of 137 per cent in export of medicinal plants in global market from Rs.554 crore in 2005-06 to Rs.1,318crore in 2010-11 (www.ians.com)
Indian basil is extensively cultivated in Indonesia, Egypt, Morocco, France, Greece, Hungary, and the United States (Bahl *et al*. 2000) [4]. In India, it is mainly cultivated in the states of Assam, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Maharashtra, and Jammu (Prakasha Rao *et al*. 2007) [13]. The estimated production of basil oil in India is 250 tons, and this oil has methyl chevicol and linalool as the major constituents (Maheshwari 1995) [11]. Its different parts of the plants are claimed to be valuable in a wide spectrum of diseases like stomach spasms, loss of appetite, intestinal gas, kidney conditions, fluid retention, head colds, warts and worm infections. It is also used to treat snake and insect bites. (Lal *et al*., 2003) [10].
In todays world, medicinal plants are being used for commercial cultivation for the increased income. However, technologies to develop seedling are not very well popularized among the farming community. Indian basil is seed propagated and its commercial growers suffer major losses caused by substandard seeds, it is essential to assess the germination potential and vigor for ensuring the crop stand and herb yield.

Materials and Methods
Basil (*Ocimum basilicum* L.) fruits collected from farmer's field at Periyakulam served as the base material. The laboratory experiments were conducted at unit of Seed Science and Technology, Department of Plant Breeding and Genetics, Agricultural college and Research Institute, Killikulam. The uniformly graded seeds were soaked in water adopting the seed to water ratio of 1:1 for duration of 2, 4, 6, 8 and 12 h under ambient conditions. The seeds were then dried back to their original moisture content (9%). The hydrated seeds were evaluated for physiological seed quality characters *viz*., germination percentage, abnormal seedling percentage, fresh ungerminated seed percentage, root length, shoot length and vigour index along with control (unprimed seed).

Germination (%)

The seeds of each seed source were sown in sand media prepared as per ISTA (2010) [8] and pure seeds were sown as four replications of 100 seeds and were placed in a germination room maintained at 25±2 ºC temperature and 95±2% relative humidity. After the germination period of 11 days, the seedlings were evaluated as normal and abnormal seedlings and dead seeds. Based on the normal seedlings the germination percentage was calculated adopting the following formula.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings produced}}{\text{Total number of seeds sown}} \text{ X } 100$$

Root and shoot length (cm)

Ten normal seedlings of the germination test after the required germination period were randomly selected in each of the replications and sources and the length between the collar region to the tip of primary root were measured for root length and the collar region to the tip of the true leaves for shoot length using measuring scale and the mean expressed as in centimeter.

Vigour index

The vigour index values were computed adopting the following formula proposed by Abdul-Baki and Anderson, (1973) [1] and the mean expressed as vigour index in whole number.

Vigour index = Germination (%) x Total seedling length (cm)

Result and Discussion

Highly significant differences were obtained for all the studied parameters *viz*., germination, Abnormal seedling percentage, fresh ungerminated seed, root length, shoot length and vigour index showed highly significant variations due to hydro priming treatments.

Germination percentage

As the hydro priming treatment, significant difference in seed germination percentage was noticed. The hydro priming 12 h recorded maximum germination percentage (70%), while control seeds recorded the minimum values of germination (52 %) (Table 1 and Fig.1). Hydropriming allows the seeds to quickly reach a high level of moisture with a constant supply of oxygen, thus increasing the level of metabolites associated with the germination process (intermediate metabolites) and enzymes associated with the production of energy (Duffus *et al*., 1985) [5]. Theophrastus (372-287 BC) had recommended presoaking of cucumber seeds in milk or water to make them germinate earlier and for production of vigorous seedlings. Later, Heydecker (1973) [7] successfully used seed priming to improve germination and emergence under stressful conditions.

Abnormal seedling and fresh ungerminated seeds percentage

Highly significant differences were recorded for abnormal seedling percentage due to hydro priming. The hydro priming 6 h recorded minimum abnormal seedling percentage (20 %) followed by hydro priming 12 h (22%), while control seeds recorded the maximum abnormal seedling percentage (38%). Significant differences were recorded for fresh ungerminated seeds also due to hydro priming. The hydro priming 12 h and 2 h recorded minimum fresh ungerminated seeds (8 %), while 6 h hydro priming recorded the maximum fresh ungerminated seeds (14 %) followed by 4 h (12%) and control seeds (10%) (Table 1).

Root and shoot length

Significant differences were observed for root length due to hydro priming. Hydro priming 12 h (1.9 cm) produced longest roots. The shortest root produced by control (0.2 cm). The differences were observed for shoot length among different hydro priming treatments. Longest shoot was recorded in Hydro priming 12 h (2.4 cm). The shortest shoot produced by control (1.4 cm) (Table 1). Heydecker and Coolbar (1977) [6] explained hydro priming as the imbibition of water that activates the physiological process, mitochondrial activity, formation of vital molecule protein that resulted in release of energy. So hydro priming increases the root and shoot length.

Vigour index

Among the hydro priming treatment, hydro priming 12 h recorded highest vigour index (301) compared to the control (83) (Table 1 and Fig.1). Researchers exposed hydro priming as a simple seed management technique that had proven invigourative effect in crop seeds like hot pepper (Amjad *et al*., 2007) [3], radish (Nethaji, 2006) [12], bitter and ash gourd (Abila, 2008) [2] and Bael (Venudevan and Srimathi, 2013) [14].

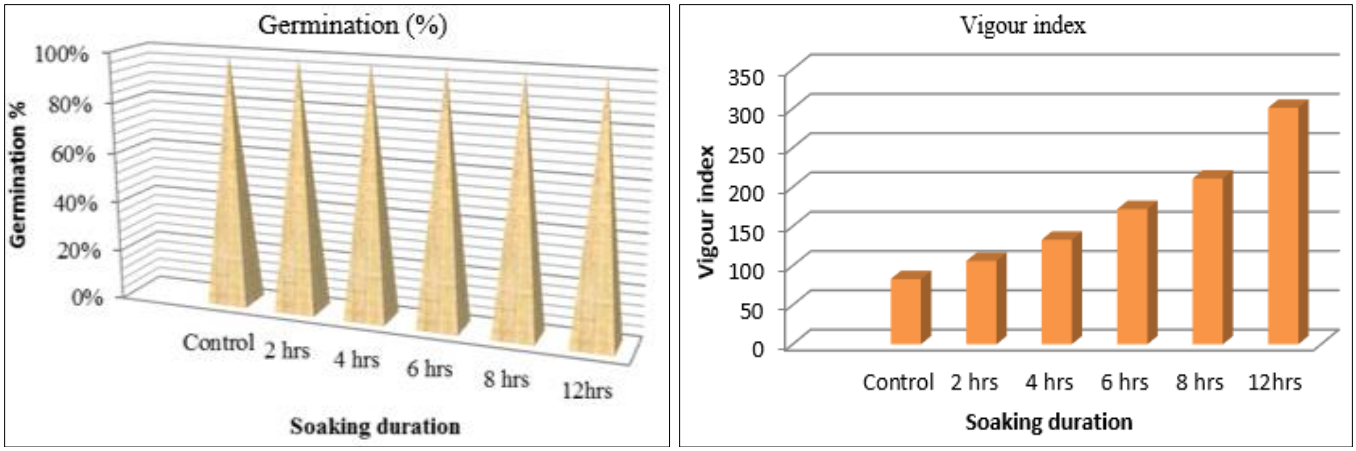

Fig 1: Influence of soaking durations on physiological seed quality characters

Table 1: Effect of hydro priming on seed quality in basil (*Ocimum basilicum* L.)

Treatments	Germination %	Abnormal seedling %	Fresh Ungerminated seed %	Root length (cm)	Shoot length (cm)	Vigour Index
Control	52 (46.147)	38	10	0.2	1.4	83
2 hrs	56 (48.447)	36	8	0.4	1.5	106
4 hrs	58 (49.604)	30	12	0.5	1.8	133
6 hrs	66 (54.333)	20	14	0.7	1.9	172
8 hrs	66 (54.333)	22	12	1.2	2.0	211
12hrs	70 (56.790)	22	8	1.9	2.4	301
Mean	61 (51.356)	28	11	0.8	1.8	168
SEd	0.5335	0.2711	0.1645	0.0095	0.0264	2.5360
CD (*P*=0.05)	1.1208	0.5697	0.3456	0.0199	0.0554	5.3280

Figures in parentheses indicate transformed (arcsine) values

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